Functional Dependency

- The attributes of a relation is said to be dependent on each other when an attribute of a table uniquely identifies another attribute of the same table. This is called functional dependency.

- If attribute A of a relation uniquely identifies the attribute B of same relation then it can represented as $A \rightarrow B$

which means attribute B is functionally dependent on attribute A.

Functional Dependency

R = { Emp_no, name, salary, branch_no, branch_add}

Functional Dependencies – {emp_no → name, emp_no → salary,
emp_no → branch_no,
branch_no → branch_add}

R = {Name, Course, Ph_No, Major, Prof, Grade}

Functional Dependencies – {name → ph_no,
Name → major,
Course → prof,
Name,course → grade }

Dependencies and Logical Implications

Consider

relation schema - R

Set of FDs – F

then any functional dependency

$$x \rightarrow y$$

is said to be logically implied from F if that FD can be logically derived from FDs, satisfied on relation schema R

$$F \models x \rightarrow y$$

Inference or Armstrong's Axioms

F1 : Reflexivity : $\mathbf{x \rightarrow x}$

F2 : Augmentation :

$x \rightarrow y \models \mathbf{xz \rightarrow yz}$

F3 : Transitivity :

$x \rightarrow y$ and $y \rightarrow z \models \mathbf{x \rightarrow z}$

F4 : Additivity :

$x \rightarrow y$ and $x \rightarrow z \models \mathbf{x \rightarrow yz}$

F5 : Projectivity :

$x \rightarrow yz \models$ $\mathbf{x \rightarrow y}$ **and** $\mathbf{x \rightarrow z}$

F6 : Pseudotransitivity :

$x \rightarrow y$ and $yz \rightarrow w \models \mathbf{xz \rightarrow w}$

Example

Eg – R=(A,B,C,D) and F = {$A \rightarrow B$, $A \rightarrow C$, $BC \rightarrow D$}

Using additivity rule $A \rightarrow B$ and $A \rightarrow C$ will be

$$F \models A \rightarrow BC$$

Using transitivity rule $A \rightarrow BC$ and $BC \rightarrow D$ will be

$$F \models A \rightarrow D$$